Visual Resource Study for the DRY LAKE WIND PROJECT

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1.0 Introduction

PPM Energy, Inc. (PPM) is proposing to construct, operate, and maintain a wind generation facility in Navajo County, Arizona, that is located about 6 to 18 miles north northwest of the City of Snowflake, just east of Arizona State Highway 377 and southwest of the I-40 corridor. The Dry Lake Wind Project would provide up to 379 megawatts (MW) of wind energy and consist of at least two phases of construction:

- Phase I, which would include up to 64 MW of wind energy with up to 30 wind turbines of 2.1 MW each (or equivalent), access roads, an interconnection substation, an operations and maintenance facility, and collector lines to transmit the generated energy to the substation.
- Subsequent phases would include up to 314 MW of additional wind-generated energy.

The turbines, access roads, collector lines, substation and operations and maintenance facilities would be constructed on private leased land, Arizona state lands and lands managed by the U.S. Department of the Interior Bureau of Land Management (BLM).

This visual resource study describes current visual conditions and identifies potential project impacts to the aesthetic environment. This visual study included an evaluation of existing visual conditions such as landscape character and scenic quality as well as an impact assessment using visual contrast rating and viewer sensitivity evaluation. There are no formal guidelines for managing visual resources on private, state, or tribal lands; therefore, the BLM Visual Resource Management (VRM) system was used as an objective methodology to assess the aesthetic conditions of the landscape, establish a characterization of the current viewing environment, and evaluate potential impacts to the environment. The BLM VRM method and guidelines were also used in assessing landscapes outside of areas where formal guidelines apply (i.e., non-BLM-administered lands). Specifically, the VRM system was used to thoroughly assess:

- Inherent aesthetics within the landscape
- Project visibility and viewer sensitivity to change
- Visual contrast and the impact of human modification to the natural landscape

Aerial photography, ground reconnaissance, topographic maps, agency contacts, and reference documents were used in conducting the visual resource analysis.

1.1 Methodology

The VRM system guided the visual resource analysis for the Dry Lake Wind Project and provided the framework for this visual resource study. The *BLM Manual H-8410-1 Visual Resource Inventory* (BLM 1986a) was used to inventory existing aesthetic conditions and evaluate visual sensitivity for the purposes of applying VRM guidelines to public lands. The Visual Resource Inventory (VRI) was conducted and completed by BLM Safford Field Office (Wilbanks 2007). Additionally, *BLM Manual 8431: Visual Resource Contrast Rating* (BLM 1986b) was used to determine the extent to which management activities will conform to guidelines identified by the BLM.

2.0 Environmental Conditions

The study area for visual resources is defined as the area wherein potential undesirable visual effects from construction, operation, and maintenance of the proposed project may be discerned.

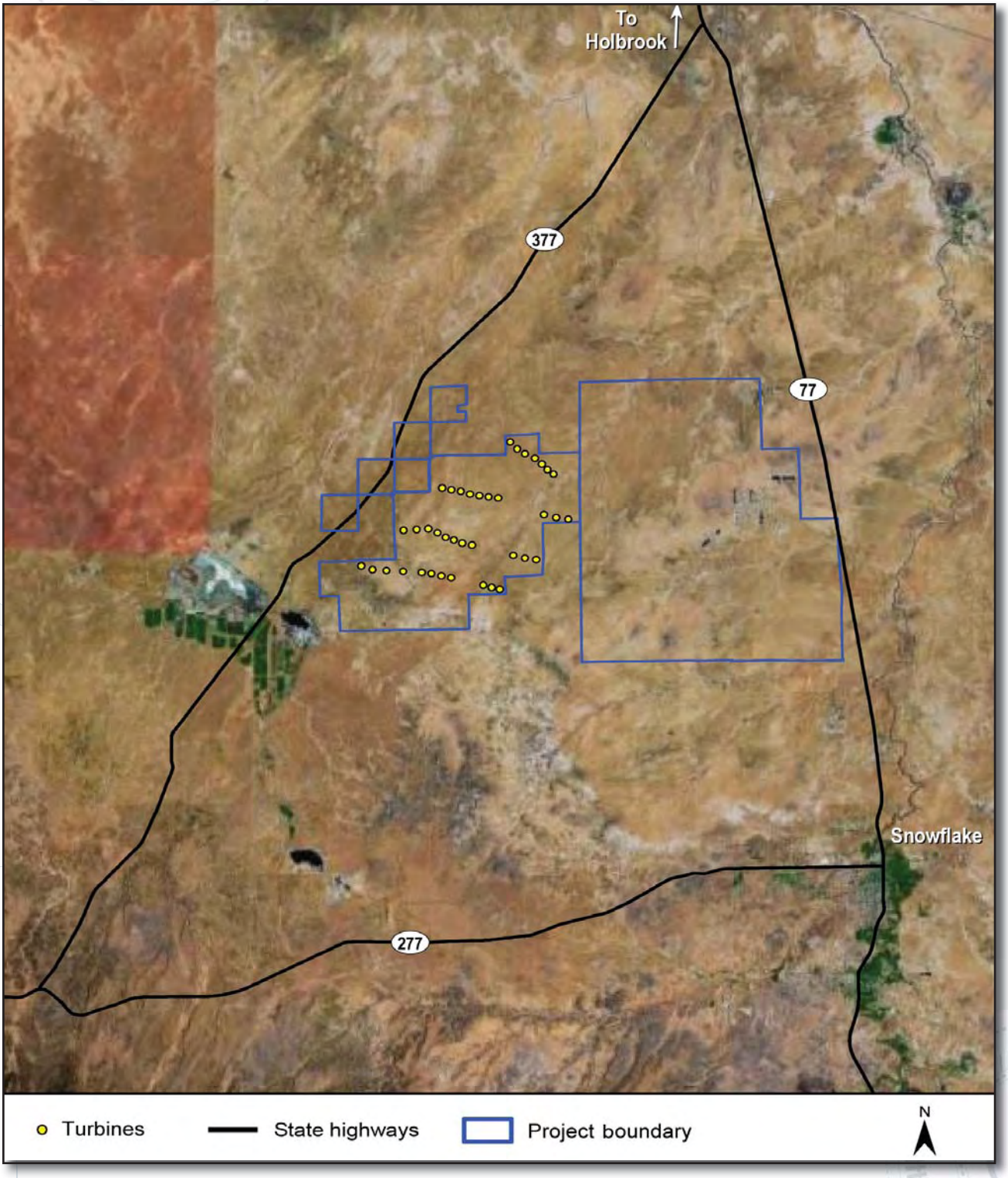
The Dry Lake Wind Project study area is located in a remote area of Navajo County, Arizona in the northeastern quarter of the State. Landscape within the study area is relatively flat, roughly ranging from 5,500 feet to 6,000 feet in elevation. The study area is characterized by the occasional cuesta, butte, or rock outcropping. The soil is reddish brown and sandy and the landscape is interspersed with patches of desert grasses, creosote, and pinyon-juniper vegetation. Most of the study area is undeveloped landscape bisected by unimproved (two-track) roads, an existing 69kV transmission line, livestock improvement facilities (e.g., fencing, cattle guard, water tanks, and dirt tanks), water wells with cyclone fencing, and other agricultural and industrial development several miles to the southwest and to the east of the proposed project site (Figure 1 - Visual Resource Study Area).

2.1 Landscape Character

Landscape character gives a geographic area its visual and cultural image, and consists of a combination of physical, biological, and cultural attributes that make each landscape unique or identifiable. Landscape character embodies distinct landscape attributes that exist throughout an area. Landscape character, as defined by BLM, is the “overall impression created by its unique combination of visual features such as land, vegetation, water, and structures as seen in terms of form, line, color and texture” (BLM 1986a).

Landscape in the study area is characterized as panoramic, whereas there is little or no “sense of boundary” restriction, and foreground and middleground objects do not substantially impede viewing of background objects.

Figure 1 - Visual Resource Study Area Map



2.1.1 Landscape Character Types

Landscape character types provide the opportunity to make specific distinctions between landscapes within the study area based on the visual expression of local vegetative patterns, landforms, rock formations, waterforms, and land use patterns. Given the relative continuity and homogeneity of landscape in the region, the study area is characterized as desert plains landscape, the most common landscape character type in the study area and the region.

The desert plains landscape character type ranges from virtual desert pavement to relatively dense low-lying desert scrub vegetation. Various types of sedimentary rock lend texture and color variation to the landscape. The topography in the desert plains landscape can vary from flat to rolling hills but remains relatively homogenous. Dominant landforms within the region include scattered flat-topped mesas, cuestas, buttes, or rock outcroppings which are more noticeable from a desert plains setting because of the flat, unobstructed viewing conditions. As such, cultural modifications including residences, industrial development (e.g., transmission lines, substations), and roads can be visually evident within the desert plains landscape.

2.2 Visual Resource Management Classification

The VRM system provides guidance in the management of public lands. In tandem with BLM's overall multiple-use land management approach, BLM places emphasis on maintaining scenic quality by assigning VRM classes to guide development activities. VRM classes (described in Table 2-1) each have a management objective that stipulates the level of acceptable change in the landscape.

The study area is located entirely within VRM Class IV landscape allowing major modification to the existing landscape (Wilbanks 2007).

Table 2-1: VRM Class Objectives Defined

VRM Class	VRM Class Objectives
Class I	Those areas where a management decision has been made previously to maintain a natural landscape (e.g., wilderness areas, National Wild and Scenic River designations, other Congressionally or Administratively designated areas). The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II	Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the characteristic landscape. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.
Class III	Changes in the basic elements (form, line, color, texture) caused by management activity may be evident in the characteristic landscape; however, the changes should remain subordinate to the visual strength of the existing character. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV	Changes may be subordinate to the original composition and character but must reflect what could be a natural occurrence within the characteristic landscape. The objective of this class is to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through strategic siting designed to minimize disturbance to the area through repetition of the basic elements of form found in the characteristic landscape.

Source: *BLM Manual H-8410-1 Visual Resource Inventory. 1986.*

2.3 Scenic Quality

Scenic quality classes were used to evaluate the natural landscape based on the degree of distinctiveness, which takes into consideration such factors as landform, vegetation, color, water, adjacent scenery, scarcity, and cultural modification. Scenic quality is determined by rating the distinctiveness and diversity of interest of a particular natural landscape (described in Table 2-2). There are no Class A (unique) landscapes in the study area, most of the scenic quality in the study area is considered Class C (common).

Table 2-2: Scenic Quality Classes Defined

Scenic Quality Class	Scenic Quality Class Definition
Class A	Landscapes are represented by unique lands of outstanding or distinctive diversity or interest, including high-relief mountains, escarpments, highly dissected canyons, monumental landforms, and scenic riverways.
Class B	Landscapes are lands of above-average diversity of interest and consist of rolling, vegetated hills and valleys, mesas, buttes, and unique landforms that define the environment.
Class C	Landscapes are primarily common and of minimal diversity, such as high desert plateaus and desert plains areas with few distinguishing features.

Source: *BLM Manual H-8410-1 Visual Resource Inventory. 1986.*

The natural landscape within the study area is considered of common scenic quality because it is relatively flat and has little or no vegetation or color contrast, is devoid of unique water features, and is high desert plains landscape with few distinguishing landforms or unique features.

3.0 Environmental Consequences

Facing west along SR 77

Facing north within the study area

Facing northeast within the study area

Impacts would result from substantial degradation of the character of a landscape where the basic elements of the landscape are interfered with or where the introduction of visual changes in the landscape include partial or full blockages of scenic viewsheds where views are currently unobstructed.

Two types of impacts were evaluated for this study:

- Impacts to the general scenic quality within the natural environment
- Impacts to views as related to specific viewer types

Impacts were evaluated using visual contrast rating and viewer sensitivity evaluation.

3.1 Visual Contrast

Visual contrast is the measure of the degree of perceived change that would occur in the landscape due to potential impacts from the project (i.e., construction, operation, reclamation). Overall visual contrast is determined through the evaluation of landform, vegetation, and structure contrast, whereby the degree of impact from the proposed facilities on the natural landscape is determined (Table 3-1). The BLM typically defines contrast in terms of landform, vegetation, and structure. For the purposes of this study, visual contrast was considered an amalgam of all three types of contrast in the landscape and was used, in conjunction with other techniques, to assess the impact of the proposed project on the landscape.

Table 3-1: Contrast Types Defined

Contrast Type	Definition
Landform Contrast	Landform contrast is the change in landform patterns caused by exposure of soils, disturbance to natural contours and/or geologic formations, and other noticeable modifications uncharacteristic to the natural landscape
Vegetation Contrast	Vegetation contrast is established by examining the diversity and complexity of existing vegetation and determining to what degree vegetation would be disturbed to construct roads, maintain right-of-way, and locate new project facilities. Typically, the more diverse and dense the vegetation, the higher the contrast level. The removal of vegetation in a vacant/undisturbed area can create a distinct line, which inherently draws viewer attention to the modification.
Structure Contrast	Structure contrast is the change by which proposed project facilities would differ from the surrounding landscape character. The introduction of new or modified structures into the existing landscape would create visual changes; however, these changes may not be as noticeable in a previously disturbed setting with the same/similar structures. The most substantial structural contrasts would result from the introduction of new facilities into an undisturbed setting. Adjacent existing development, such as power lines, roads, and other utility structures, reduces the degree of structural contrast. Typically, the construction of project facilities is less noticeable in industrial settings or in areas where other features dominate the setting.
Visual Contrast	Visual contrast is derived from a combined analysis of landform, vegetation, and structural contrast. Visual contrast is a measure of the degree of perceived change that would occur in the landscape due to the construction and operation of the proposed project. Visual contrast typically results from (1) landform modification necessary to upgrade/construct new access roads (2) removal of vegetation to construct roads or maintain right-of-way (3) introduction of new structures in the landscape.

Source: Derived from *BLM Manual 8431 Visual Contrast Rating. 1986., and professional experience.*

3.2 Viewer Sensitivity

Viewer sensitivity was assessed through the identification of sensitive viewpoints and a viewshed analysis simulating visibility of the proposed project facilities using geographic information systems digital elevation modeling (Figure 2 - Viewshed map).

Potential sensitive views of the proposed project were identified during an on-site field reconnaissance. Typically, highly sensitive views include occupied residences, recreational areas, and travelers on scenic routes. However, given the rural location of the study area, few residences, recreational areas, or scenic routes were inventoried. Key observation points (or potentially critical viewpoints) were identified along the main travel corridor (i.e., SR 377). Visual simulations were performed based on the viewshed analysis, computer mapping, and an on-site field reconnaissance resulting in the creation of a digital rendering of the wind turbines in the existing landscape. The visual simulations provided a general depiction of the scale and significance of the wind turbines as they would likely appear from selected key observation points (Figure 3 - Visual Simulation).

Viewer sensitivity was determined through assessment of types of viewers (e.g., travelers from roads), land uses oriented toward proposed project facilities (e.g., residents or natural recreation areas), volume (or numbers) of viewers, duration of time spent viewing the landscape, and finally, influence of adjacent land use on the view (e.g., presence of an existing industrial facility within the viewshed).

The viewshed analysis which generated Figure 2 – Viewshed Map was performed using a Digital Elevation Model (DEM) and took into consideration stationary views from 1 meter off the ground. The area in pink indicates where views of the structures would be obstructed because of topography, elevation, slope and other geological impediments. The DEM does not take into consideration vegetation which may also impede or obstruct views.

The DEM gives an estimation of viewing conditions within the project area and was used in combination with other methods of analysis to determine the impacts to the viewing landscape.

3.3 Distance Zones

To study the impacts of the project on the visual environment, distance zones were delineated for all project components and were factored into the visual analysis. Distance zones were established based on perception thresholds, the scale and nature of objects being viewed, and the viewing environment. The perception of landscape character, including form, line, color, and texture, is, among other complex phenomena, largely a function of changing distance from a viewpoint. Landscape elements tend to become less obvious and less detailed at greater distances. Perception of texture and color become less noticeable with increased distance. Distance zones were established separately for wind turbines because of the difference in scale and structure size when compared with other proposed project facilities (Table 3-2).

Figure 2: Viewshed Map

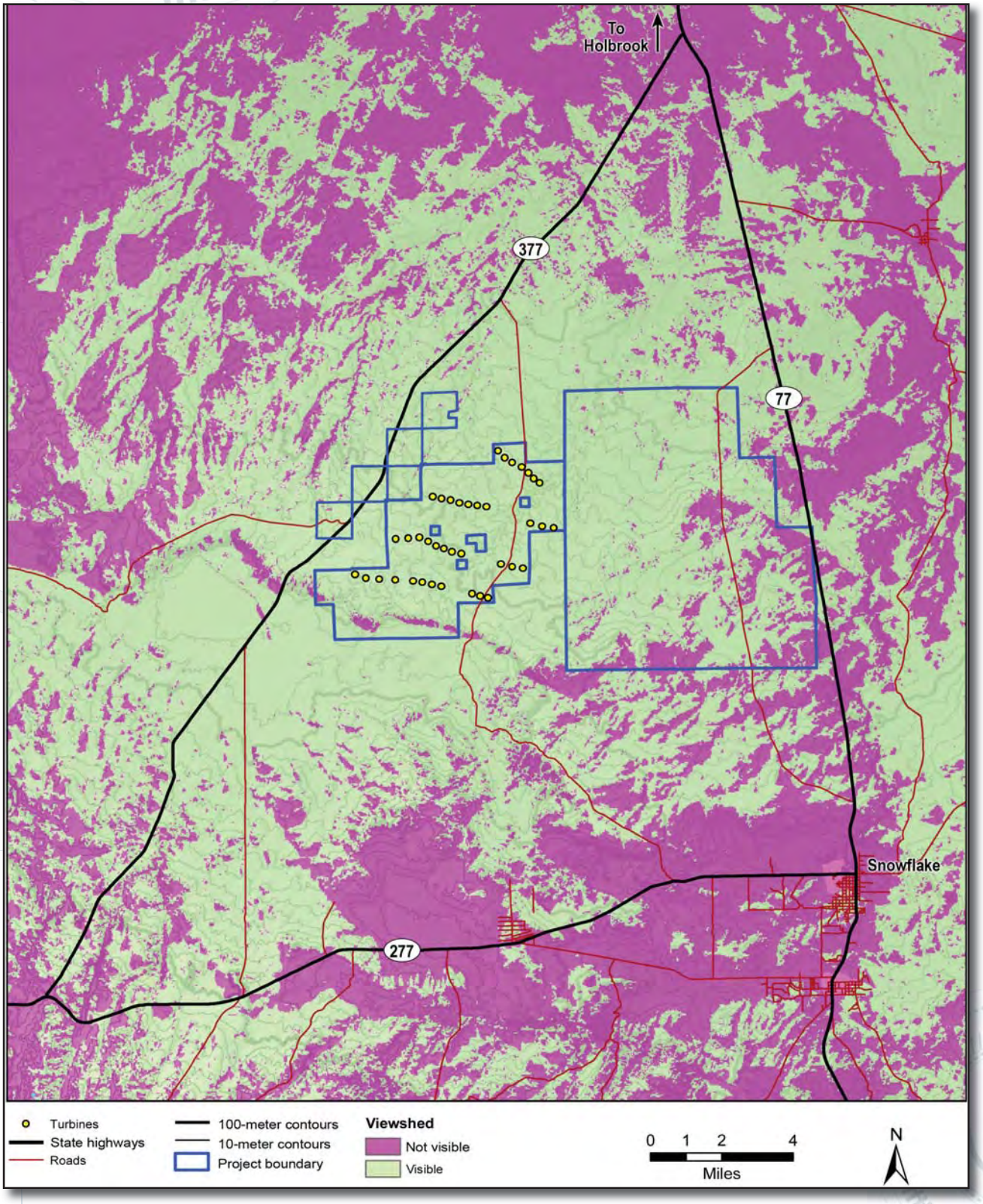


Table 3-2: Distance Zones for Wind Turbines (in miles)

Immediate Foreground	0–1.5
Foreground	1.5–4.0
Middleground	4.0–10.0
Background	10.0–18.0
Seldom Seen	18.0+

The distance zones for transmission lines, substations, and operations and maintenance buildings are listed in Table 3-3.

Table 3-3: Distance Zones for Other Project Components (in miles)

Immediate Foreground	0–0.10
Foreground	0.10–0.5
Middleground	0.5–1.0
Background	1.0–3.0
Seldom Seen	3.0+

3.4 Impact Criteria

Impact levels are classified as “major”, “moderate”, “minor”, “negligible”, and “none” (Table 3-4). The impact evaluation took into consideration landscape character, scenic quality, distance zones, visual contrast, and viewer sensitivity. Impact criteria were applied to the proposed project facilities and the projected effects combined with planned mitigation efforts were compared to the existing environment to determine the severity of impacts on visual resources.

Table 3-4: Visual Resource Impact Levels Defined

Contrast Type	Generally Defined	Definition Specific to Visual Resources	Examples
Major	Impacts that potentially would cause significant change or stress to an environmental resource or use, or severe adverse or exceptional beneficial effects.	Visual contrasts resulting from construction disturbances and the presence of new facilities that would substantially alter the scenic value of the landscape and would dominate views from sensitive viewpoints.	• Structures that significantly impede and obstruct scenic views • Construction that would irrevocably damage scenic quality • Facilities that would be seen in the foreground to middleground distance zones in previously undisturbed, highly scenic landscapes.

Contrast Type	Generally Defined	Definition Specific to Visual Resources	Examples
Moderate	Impacts that potentially would cause some change or stress (ranging between significant and insignificant) to an environmental resource or use, or readily apparent effects to scenic quality	Visual contrasts that would diminish the scenic quality of the landscape and would easily be noticeable from sensitive viewpoints.	• Vertical utility structures that may detract from existing scenic quality • Facilities would be visible in the foreground to middleground distance zones from sensitive viewpoints • Facilities parallel to highly scenic landscapes that have not been previously disturbed.
Minor	Impacts that are potentially detectable but slight.	Visual contrasts that diminish the scenic quality of the landscape to a minimal degree and are potentially noticeable when viewed from moderately sensitive viewpoints.	• Facilities would be visible in middleground or background distance zones from moderate sensitivity viewpoints, or parallel to existing facilities in previously disturbed landscape, or landscapes of common scenic quality.
Negligible	Impacts that potentially cause an insignificant or indiscernible change or stress to an environmental resource or use, impacts range from immeasurable and undetectable to low levels of detection.	Visual contrasts that would not dinmish the scenic quality of the landscape.	• Temporarily displacing vegetation while maintenance and/or construction occurs • Facilities would be visible in the background distance zone, where new facilities parallel existing facilities or traverse previously disturbed landscape in landscapes of common to minimal scenic quality.
None	No discernable or measurable impacts would result.	No discernable or measurable visual contrast.	• No project activity would take place.

FIGURE 3 - Visual Simulations

Visual Simulations - Continued

Visual Simulations - Continued

Visual Simulations - Continued

3.5 Proposed Action

3.5.1 Wind Turbines and Wind Energy Generating Facilities

The proposed wind turbines would stand approximately 150 meters in height and would be located on landscape considered Class C or “common” in scenic quality. Viewers sensitive to the structures were identified as travelers predominantly along SR 377 as views of the proposed structures would be most evident in this area. No existing residents (high sensitivity viewers) would be likely to view the structures because of distance and obstructing elevations (Figure 2 – Viewshed map). Additionally, dispersed recreationists (moderate sensitivity viewers) could be affected; however, the difficulty of predicting unofficial recreational locations, attitudes, orientation, and other highly variable factors preclude such viewers from study.

The introduction of the wind turbine into the current landscape would result in a “minor” impact because the structures would be noticeable to some viewers within the foreground or middleground but would not likely be seen by moderate (e.g., travelers on SR 377) or high sensitivity viewers (e.g., residents within foreground distance zones). Overall sensitivity to modifications on the landscape is considered low because of limited access for recreationists, few existing residences within the viewshed, and limited time exposed to the proposed facilities when passing the study area by car.

The introduction of the wind turbines into the visual environment would not result in irrevocable damage to the scenic quality because the existing landscape is considered Class C, with few distinguishing features. Additionally, major population centers in the area (e.g., Heber, Holbrook, Snowflake) are considered to be outside of the viewing area of the structures because of topographic relief, vegetation, slope and distance.

The wind turbines would be the most visible feature of the proposed facilities given the structure size, height, and rotation of moving blades; several other facilities, however, would be required to support wind energy generation, including:

- Meteorological towers (i.e., two permanent, free-standing towers, approximately 60 meters tall)
- Electrical collection and distribution systems (i.e., pad mounted transformer, substation, switching station)
- Electrical substation and operations and maintenance facility (i.e., an electrical substation located on a 2-acre site with a concrete pad and electrical transformers, and a 5,000-square-foot metal operation and maintenance building located on a 4-acre cleared area with a gravel storage pad)

- Access roads (i.e., permanent roads, 16 to 20 feet wide, and temporary roads used for turbine construction and crane transport, 35 feet wide and restored to 16 to 20 feet wide after construction)
- Laydown areas (i.e., 2-acre gravel area located at the beginning of each turbine string during construction)

Some potential visual impacts that could affect viewers and/or scenic quality include ground disturbance at turbine sites, turbine construction, road construction, Federal Aviation Administration (FAA) flashing red or white lights mounted on the nacelle of the wind turbine, and the motion of overlapping blade rotation causing discordant visual patterns. However, the project area in total is located in obstructed background views of the nearest residents (high sensitivity viewers), and travelers along SR 377 (moderate sensitivity viewers) would have limited opportunity to see the turbines because of the duration of time that views would be exposed (approximately 7 to 18 miles of roadway with a posted speed limit of 55 miles per hour).

Vertical facilities (not including the wind turbines) such as the overhead 34.5kV collector cable system and meteorological towers, would be 60 feet or less in height and would have a minor impact on the visual environment because existing transmission lines exist relatively close to the project area, resulting in less structure contrast, and views of the corridor would be only slightly noticeable in the context of the overall environment.

Lateral facilities, including roads, laydown areas, the substation, and the operation and maintenance facility, would cause some landscape contrast because of the color contrast of the disturbed topsoil. The overall impacts of these facilities on the landscape would be minor because they would be located on a landscape that is outside of highly sensitive viewing areas and disturbances to soil and vegetation would be restored after construction were to occur and the existing scenic quality would remain minimally disturbed as prescribed by BLM land management practices.

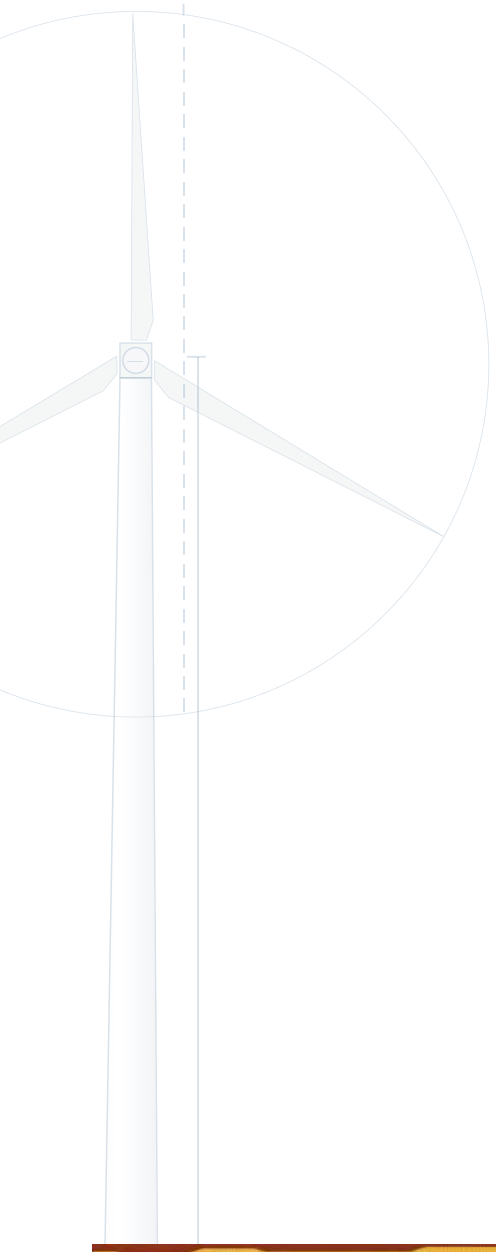
3.6 No Action

No impacts to current visual conditions would occur without the influence of the proposed project.

4.0 Mitigation

In addition to locating the wind energy facilities outside of highly sensitive viewing areas, an extensive planning effort for mitigation measures has been made to minimize potential visual disruption during the construction and operation of the proposed project. During the construction phase, water or chemical suppressants would be used to minimize the generation of dust from the movement of earth. Additionally, work would take place on days with low wind velocity.

Because of the structural nature of the wind turbines and turbine arrays, the design of the proposed facility would be integrated with the surrounding landscape. Visual uniformity has been taken into consideration as a design element, and the structures would be constructed as tubular towers, painted with non-reflective paints. FAA requires that structures over a certain height have red or white flashing lights. These lights would be mounted at the nacelle of the wind turbine, and located at the ends and middle of the turbine strings. Additional lighting at the substation and operations and maintenance facility would be limited to reduce nighttime light pollution through the use of directed lighting, timers and motion sensors.



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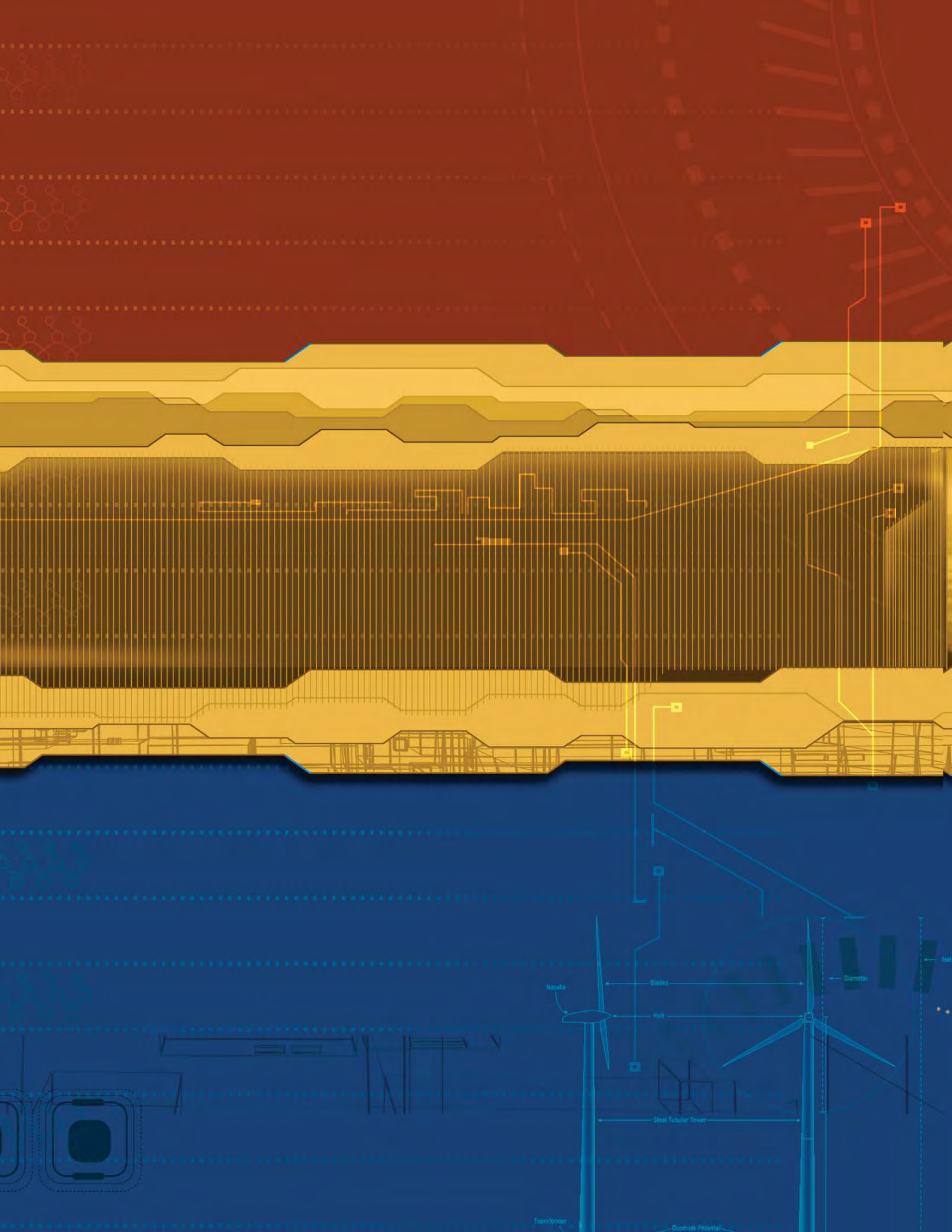
Nacelle
Blades
Diameter
Hub
Steel Tubular Tower
Transformer
Concrete Pedestal